REMARKS

Claims 4, 6, 8, 10 and 12 were pending in the application. In the Office Action mailed on April 29, 2009, claims 4, 6, 8, 10 and 12 are rejected. In the instant Amendment, claim 12 has been canceled, without prejudice; and claims 4, 6, 8 and 10 have been amended to correct a grammatical error. Upon entry of the instant Amendment, claims 4, 6, 8 and 10 will be pending. The amendments are proper in that they place the application in condition for allowance or in better form for appeal.

No new matter has been added by the amendment. Entry of the foregoing amendment, and consideration of the following remarks is respectfully requested.

Claim objection

Claim 12 is objected to under 37 CFR 1.75(c), as being of improper dependent form for failing to further limit the subject matter of a previous claim. Claim 12 has been canceled. The objection is therefore obviated.

Rejection under 35 U.S.C. § 103(a)

Claims 4, 6, and 12 were rejected under 35 U.S.C. § 103(a) as being unpatentable over JP2001-73071 ("Yoshiyuki") in view of JP3-153828 ("Shigeru") or JP2001-001148 ("Tomomasa"). Claims 8 and 10 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Yoshiyuki in view of Shigeru or Tomomasa, further in view of JP 2002-161329 ("Hasegawa"). Claim 12 has been canceled.

Applicants respectfully submit that the present inventors have discovered that the loss of joint strength by undermatching in the design of large-heat-input butt-welded joints over 50 mm in thickness can be improved by controlling the hardness of *the weld metal* from 70% to 110% of the hardness of the base metal and by controlling the width of the weld metal to

not more than 70% of the plate thickness of the base metal, as claimed in each of claims 4, 6, 8 and 10 (emphasis added). As is well-known in the art and disclosed in the present application, a weld metal is the metal formed by melting and solidification of the welding wire and base metal (see, e.g., Figs. 3-4, shaded area 2). In contrast, a heat affected zone (HAZ) is an area contacting the weld metal (via the fusion line FL), and is a part of the base metal (see, e.g., the specification at p. 8, ll. 15-23 and Fig. 3). As the application discloses, melting and solidification of the base metal during welding tends to make the hardness of the weld metal higher than the base metal (see, the specification at p. 13, ll. 4-11). The presently claimed invention calls for controlling, *inter alia*, the hardness of the weld metal for joint having high fracture toughness and strength (see, the specification at p. 3, ll. 15-32. Each of claims 6, 8 and 10 further specifies features in the HAZ, e.g., claim 6 recites a width of not less than 5 mm in the region affected by welding, whose hardness is softened to not more than 95% of the hardness of the base metal. This region is described in the specification as a region in the heat affected zone (HAZ) extending from the fusion line into the base metal. See, p. 14, ll. 5-9.

In contrast to the claimed invention, Yoshiyuki teaches that the difference between the hardness of the *heat affected zone* and the base metal is small. See, e.g., abstract and claim 1. Yoshiyuki discloses a steel composition devised to provide a base metal that softens only marginally when affected by the weld heat resulting in a small hardness difference between the base metal and the HAZ, thereby improving the fatigue strength and reducing the occurrence of stress-corrosion-cracking. See, para [0044]. Yoshiyuki does not suggest or disclose the hardness of the weld metal at all. A teaching of the hardness differences between the HAZ and the base metal, e.g., tabulated in Table 3 of Yoshiyuki, does not teach or suggest the claimed hardness difference between a weld metal and a base metal.

Also, the Examiner has pointed to Yoshiyuki, at paragraph 37, for teaching a steel plate of 50 mm or more. However, the first line of the cited paragraph recites "the steel plate of 50 mm *or less*..." Emphasis added. See, also, Table 3, which only exemplifies steel sheets of 50 mm or less.

Thus, a steel plate of more than 50 mm and a hardness of the weld metal being 70% to 110% of a base metal, is not disclosed or suggested by Yoshiyuki.

Neither of the secondary references teaches or suggests a steel having the recited hardness of the weld metal. Therefore, neither of the secondary references supplies what are missing in Yoshiyuki.

Regarding the Examiner's view that Shigeru teaches a weld zone narrower than the plate thickness, applicants point out that the Shigeru weld zone is the region more softened than the base metal due to welding and post-heat treatment. See, Shigeru Abstract, ll. 6-8. Applicants posit that the softened region is the HAZ, i.e., *a portion of the base metal* heated by the weld that has undergone a solid state change in microstructure. Shigeru does not disclose or suggest the claimed width of the *weld metal*, itself, being not more than 70% of the plate thickness. Regardless of the width of the weld metal, Shigeru does not remedy the deficiencies of Yoshiyuki since Shigeru does not consider the hardness of the weld metal relative to the base metal.

With respect to the Examiner's view that the disclosure by Tomomasa regarding the thickness of welded joints being less than 45% would motivate a person of ordinary skill in the art to modify the Yoshiyuki joint to arrive at the claimed joint having a weld metal width of less than 70% base metal thickness, applicants submit that the unnecessarily limiting geometric configuration taught by Tomomasa is pertinent to a different technology, i.e., high

tensile steels welded by low-heat-input methods, and further is intended to address the resulting technical issues when using a weld metal with a lower *tensile strength* than the base metal.

For example, the gas-shielded-arc welding method of Tomomasa has a heat input of 10-40 kJ/cm. See, paragraph 42. See, also Table 3, which indicates that 45 kJ/cm exceeds the scope of the disclosure. In contrast, the instantly claimed joint welding technology is relevant for large-heat-input butt-welded joints, as claimed, made with heat inputs well in excess of 40 kJ/cm, as illustrated in Table 2, which shows that the lowest heat input exemplified for the instantly claimed invention is 159 kJ/cm.

However, even assuming arguendo, that the disclosure of Tomomasa would guide an artisan to modify the width of the instantly claimed weld metal, Tomomasa does not remedy the deficiencies of Yoshiyuki for at least the reason that Tomomasa does not consider the *hardness* of the weld metal.

Hasegawa is cited for its teaching of the prior austenite grain size in the HAZ contacting the welding fusion line is not more than 200 micrometers recited in claims 8 and 10. However, Hasegawa does not teach or suggest a steel having the recited hardness of the weld metal.

Thus, the deficiencies of Yoshiyuki are not remedied by either Shigeru, Tomomasa, or Hasegawa, either individually or in combination, and a *prima facie* case of obviousness has not been established. For at least the above reasons, applicants respectfully submit that claims 2,4,6, 8, and 10 are not obvious under 35 U.S.C. § 103(a) over Yoshiyuki, Shigeru, Tomomasa and Hasegawa, either alone or taken together.

It is submitted the application is in condition for allowance. It is therefore respectfully requested that the application be allowed and passed for issue.

Respectfully submitted,

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Dated: July 29, 2009 By _____
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